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HANDBOOK

FOR THE

64-PR. R.M.L. GUN OF 64 CWT.

(MARKS I., II., III.)

LAND SERVICE.



1888.





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This Handbook is corrected up to July, 1888. Any alterations which may be suggested should be forwarded to Assistant to D. of A., Woolwich.

64-pr. R.M.L. Gun of 64 Cwt., Mark III, L.S.

The Gun.

(*List of Changes*, §§ 1062, 1608, 1990, 3622, 3718.)

Plates I., II., III.

			Mark I.	Mark II.	Mark III.
Material	Exterior	..	Wrought iron	Wrought iron	Wrought iron.
	Tube	..	Wrought iron or steel.	Wrought iron or steel.	Steel.
Weight, nominal		cwt.	64	64	64
Preponderance		cwt.	7	3	3·063
Length, total		in.	119·5	120	118
Bore	Length	cal.	15·5	15·5	15·5
		in.	98	98	97·5
	Calibre	in.	6·3	6·3	6·3
	Capacity, including chamber and grooves	c. i.	2997	3023	3037
Chamber "D."	Length	in.	7·5	7·5	7
	Diameter at entrance	in.	6·3	6·3	6·3
	Capacity	c. i.	153	179	196
Rifling	System	..	"Shunt" or plain.	"Shunt" or plain.	plain
	Twist	..	U. 1 in 40.	U. 1 in 40.	U. 1 in 40.
	Length	in.	90·5	90·5	90·5
	Grooves, number	..	3	3	3
	Grooves, depth	in.	·11	·11	·11
	Grooves, width	in.	1	1	·73
Venting, copper.—Position from end of bore		in.	6·1 or 5·2	5·2	5·2

Mark I.

The construction of this gun is of the Armstrong or original type, viz.: a barrel of coiled iron, a forged breech-piece, a B tube with muzzle-piece for the swell, four external thin coils, a trunnion ring of forged iron, and a cascable screwed into the breech to support a copper cup, which closes the end of the bore.

There was no gas escape in the earliest guns of this nature; it was introduced after a certain number had been made, and then it was placed *under* the cascable.

The guns are both side and centre sighted, with an angle of correction for drift of 2° 16′.

The rifling at first was the "Shunt" groove with a uniform twist of 1 turn in 40 calibres. This form of groove was applied to all marks of the 64-pr. guns in succession, and to larger experimental pieces as well, but in 1870 it was decided to abolish the shunt system, and the "plain" groove was adopted instead; this is simply the deep portion of the shunt, that the alteration might not affect the projectiles in use with these guns. It was ordered also that this change should be made in all existing 64-pr. guns on being repaired with a new barrel, so the shunt system is gradually becoming extinct.

Mark II.

Only a few guns of this pattern were made in the year 1866. It differs from the Mark I. in being built up of fewer parts, in exterior shape, and in the end of the barrel being closed by a wrought-iron plug, a copper disc intervening between the plug and the cascable screw. The swell at the muzzle is abolished and the chase is formed by the barrel itself, which is made of double thickness until reinforced by a coil. The gun is cylindrical from the breech to the trunnions, and the trunnion ring is welded to the breech coil to give longitudinal strength. Hook joints were also introduced for the same reason wherever the portions overlapped one another to "break joint" in the construction. These guns were marked with the letter "B" on the left trunnion at first, as an indication of pattern before the numerals were adopted as a general mode of distinction.

In rifling, sights, ammunition, &c., the Marks I. and II. 64-pr. guns are exactly alike.

Mark III.

The manufacture of Mark III. was commenced in 1867, in consequence of experiments which proved that this system of construction was stronger than that in which a forged breech-piece was used. The alteration mainly consisted in the adoption of a jacket of Fraser construction (with a triple coil over the breech), which comprised nearly all the exterior metal of the gun and covered about three-fifths of the length of the barrel.

In external appearance this gun resembles Mark II., but the breech is rounded off because there are no layers in the thickness of metal, which is all welded into one solid mass.

Guns of this pattern issued prior to March, 1868, have D stamped on the left trunnion; but this letter is removed as opportunity offers, and Mark III. engraved in its stead.

These Mark III. guns, which have a wrought-iron barrel, are now being re-tubed with barrels of steel.

In 1871 solid-ended steel barrels were adopted in lieu of the coiled iron tubes, and a B tube of coiled iron was shrunk over the chase. This change in construction, however, did not constitute a new mark of gun though the alteration led to an increase of strength, with a consequent increase of charge. The shunt groove will not be found in a steel barrel.

The angle of sighting is 2° 50′ for these, but 2° 16′ in all other 64-pr. guns.

With change of design a slight difference was made in the dimensions of the cone at the end of the bore, and this point has been complicated further by the repair of many guns with a new A tube, an operation which was always carried out according to the latest method approved, and not according to the Mark of the gun. In 1880 it became necessary to affix some distinctive mark on these guns to indicate the form of the chamber and to govern the distribution of sponges; so an order was given to have the letters A, B, C, or D stamped on the face of the muzzle. The varieties of form and the dimensions in each case are given in Plate III.

Marks I. and II. are repaired with coiled iron barrels, with a coned end of the C form; all Mark III. guns are re-tubed with steel, and these have the D form of chamber; consequently, the A and B chambers are gradually being abolished.

Sights.

The gun is provided with six sights, viz., two tangent, one centre hind, two trunnion, and one centre fore.

The bar of the tangent sight fits into a gun-metal socket, and is furnished with a movable clamp; it is graduated up to 15°, with intervals of .10′ and has also yard and fuze scales; the head gives 50′ deflection R. and L., and is fitted with a milled nut giving elevation from 1′ to 10′.

The centre hind-sight of gun-metal is hexagonal in form, and drops into a socket fitted with a clamping screw; it is graduated to 5°, and furnished with yard and fuze scales.

The trunnion sights are of the drop pattern, with hog-back leaf: the centre fore-sight is similar, but shorter.

The above tangent sights will probably be superseded by "Sights R. M. L. reversible leaf" giving 3° deflection right and left.

Carriages and Platforms.

Carriage, garrison, R.M.L., 64-pr., 64 cwt., common, wood.

With Wood Trucks (converted naval).

(*List of Changes*, § 2468.)

Plate II.

This carriage consists of two brackets of elm, connected by a transom of the same material, and two axle-trees of oak.

It stands upon four elm trucks which are kept in position by iron linch pins. The front trucks are 18 in. in diameter, the rear 16 in.

The gun is laid by means of an iron screw, which works in a metal nut, and is turned by a ratchet head and lever.

The nut is let into a swing block, pivoted to the rear axle-tree, so that it can be swung clear to admit of the screw being placed in a similar nut let in the axle-tree. This arrangement allows a higher

angle of elevation, which can be still further ncreased by removing the screw and laying the gun by means of a hand coin inserted between it and the axle-tree.

The following are the maximum elevations obtainable:—

	Elevation.	Depression.
With screw and swing block	0°	10°
With screw, swing block removed ..	11°	0°
Without screw or swing block ..	19°	0°

A leather loop for the priming irons is fixed to the left side.

Weight, 8½ cwt.
Tonnage, 2 tons.

Carriage, garrison, sliding, medium, No. 9.

(Iron, R.M.L., 64-pr. 64 cwt., 5 ft. 6 ins. parapet for platform, No. 9.)

Platform, traversing, medium, No. 9.

(Iron, R.M.L., 64-pr. 64 cwt., 5 ft. 6 ins. parapet for carriage, No. 9).

(*List of Changes*, § 3834.)

Plate II.

These mountings are constructed to fire over a 5 ft. 6 in. parapet with 15° elevation and 5° depression. The recoil is controlled by a hydraulic buffer in compression.

The carriage is composed of two brackets, which are iron plates ¾-in. thick, a bottom plate, and two transoms. It has front and rear rollers, the latter on an eccentric shaft.

The brackets stand on the bottom plate, to which they are attached by angle-iron bars on the outside. Angle irons are riveted round the trunnion holes to give sufficient bearing for the trunnions, and angle iron guides are riveted under the bottom plate.

Recesses for the front rollers are formed by iron flanges riveted outside the bracket plate, the axles being held in metal eccentric bearings in the flange and plate.

The rear rollers are worked by an eccentric shaft, which is held in metal flanges bolted to the brackets, to form recesses for the rollers, the bracket plates being slotted to fit over the shaft; thus the shaft and rollers can be withdrawn by removing the flanges.

Sockets for iron-pointed levers are fitted on the ends of the shaft, and stops to prevent the rollers coming into action on recoil are attached on the outside of the bracket plates.

The elevating gear is fitted on the right side only; it is worked by a hand wheel, on the spindle of which, inside the bracket, is a pinion;

this pinion gears into a large spur wheel, and on the spindle of this latter is another pinion, which gears into an arc attached to the gun. This arc is graduated from 15° elevation to 5° depression, and a circular opening with a pointer is made in the bracket plate, to indicate the elevation and depression.

The gear is clamped by means of a portion of a screw thread on the face of a metal bearing on the spur-wheel spindle working against a corresponding thread on the back of a jamming lever. On pressing this lever down the gear is clamped.

A bracket to receive the piston rod of the hydraulic buffer is bolted under the front of the bottom plate, which is stiffened by knee stays riveted to it and the front transom. A hook for the preventor rope is fixed on the rear transom, and there are also eyes for tackle, and a socket for the pricker, also a wooden step on the left bracket.

Platform.

The platform consists of two sides of girder iron bent round in front, and held together by a plate bolted to them on the inside. The rear ends are connected by a transom. Truck brackets of malleable cast steel are bolted under the sides, and they are connected in front and rear by truck and vertical plates. The trucks are held in flanged feet of malleable cast steel, similar in general form to those for wood platforms.

The flanges are secured to the truck brackets by their spindles passing through the latter, to which they are fastened by nuts. There is a feather on each flanged foot, which fits into either of four notches in the truck plate, so that the trucks can be altered by loosening the nuts for either C, D, E, or F pivots as required.

A pivot plate is attached by angle irons to the vertical plate connecting the front truck brackets, and is bolted below the truck plates in rear; holes for pivot plugs are drilled in it, corresponding to the position of the above pivots.

A bollard on a wrought-iron spindle is bolted in rear of the transom.

The hydraulic buffer, which has at each end a wrought-iron cap, is supported on plates attached to the sides of the platform. The run-off cock is in the under side of the cylinder in rear of the front supporting plate, and to this plate is attached a drip pan for the cock; a drip pan for the gland is attached by two screws to the bottom plate. The internal diameter of the buffer is 6 ins., and it will admit of a recoil of 5 ft. 6 ins.

A loading derrick with bearer is fixed on the left side near the front. The projectile is lifted into, and adjusted in the bearer by hand, and the derrick is swung round to the muzzle of the gun, when the latter is run back and depressed for loading.

The pivot block (No. 3) is 3 ft. 4·87 ins. in height; it must be fixed so as to stand 1 ft. 6·375 ins. above the top of the racers.

The sponge is fitted with a wire rope stave 8 ft. 5 ins. long. The rammer head is of the ordinary pattern, but its stave is in three pieces connected by metal folding joints, which can be made rigid by phosphor-bronze sliding collars.

The platform is fitted with a sponge tank and brackets for the side arms. A step is fitted on each side near the rear.

	ft.	in.
Height of carriage at centre of trunnions	3	6
" platform " "	3	0
Total height ..	6	6

Diameter of trucks	front	12
	rear	18
Depression for loading		19°
Hydraulic buffer	diameter of holes in piston (4)	0·8 in.
	working quantity of fluid..	5 gals.

		Front. ft.	Front. in.	Rear. ft.	Rear. in.
Radii of racers	C pivot	6	1	6	1
	D "	9	0	3	4¼
	E "	10	8¼	2	2
	F "	12	10	2	2

	Weight.	Tonnage.
Carriage	27 cwt.	2·776 tons.
Platform	58 "	4·077 "
Pivot block (No. 3) ..	10½ "	0·448 "

Carriage, garrison, sliding, medium, No. 8.

(Iron R.M.L., 64-pr. 64 cwt., Mark III gun, 6 ft. parapet, for platform No. 8.)

Platform, traversing, medium, No. 8.

(Iron R.M.L., 64-pr. 64 cwt., Mark III gun, 6 ft. parapet, for carriage No. 8.)

(*List of Changes*, §§ 3860, 3861.)

PLATE III.

The above mountings, which are designed for the 64-pr. Mark III gun, are constructed to fire over a 6-ft. parapet, with 15° elevation and 5° depression, and to allow 19° depression for loading under cover. The recoil is controlled by a circular hydraulic buffer.

The carriage is of the single plate type similar to that already described for 5 ft. 6 in. parapet, but differs in the following particulars :—

The bottom plate is 9·5 inches above the surface of the platform, and the brackets, which extend below the bottom plate, have each on the outside two malleable cast-steel brackets, the front containing three and the rear two steel rollers. Three clip plates bolted to each bracket and the bottom plate secure the carriage to the platform. A rack is fixed along the centre of the bottom plate, to gear with the teeth on the cylinder of the circular buffer.

The elevating gear, fitted on the right side only, consists of an iron hand-wheel at the front of the carriage, conveying motion by means of a shaft, bevil wheels, and a spur pinion, to the elevating arc attached to the gun. The gear is clamped by a jamming lever with a screw thread similar to that described for the 5 ft. 6 in. parapet, but the arc is retained in position by a metal guide instead of a friction roller, and the jamming lever has an iron stop to prevent its flying back on recoil.

Platform.

The platform is similar in general construction to that for the 5 ft. 6 in. parapet already described, but it is fitted with a circular buffer with brake and running-back gear, and has special rear buffer stops. It has no bollard. The pivot plate is bored for C, E, and F pivots only. The pivot block is the No. 3 mentioned on page 5.

The loading derrick is similar to that described for the 5 ft. 6 in. parapet, but is a different height. The side arms are similar to those already described.

Circular buffer.

Plate IV.

The buffer, F, is fitted between the girders, so as to gear into the rack on the carriage. It consists principally of three parts, viz. :—

A revolving cylinder, F (to contain fluid).
A fixed piston with spindle, G.
A regulating valve H.

The piston, G, is held in a boss *a*, around which the cylinder F revolves. The cylinder is geared into the rack under the carriage, and the spindle of the "piston" is secured between the sides of the platform, so as to hold the piston in one position. The cylinder is furnished with a partition inside, which, during recoil, forces the fluid against the "piston," G. The boss, *a*, has a wide shallow groove, *d*, on its exterior, which forms a passage for part of the fluid past the partition. This groove decreases gradually in depth, so that during recoil the area of the orifice presented by it is gradually reduced, and a constant mean pressure against the "piston" is

preserved. An opening, *f*, is also provided for the flow of fluid through the partition. The area of this is regulated by the valve, H, so that the power of the buffer may be adjusted to suit varying charges.

The fluid used for this buffer is mineral oil, the working quantity being 5¼ gallons.

The following implements are supplied with the circular buffer:—

Spanner, No. 1, box, piston, and valve block.
Spanner, No. 2, locking valve.
Wrench, No. 1, gland rings.
Wrench, No. 2 { and screw-driver, securing valve, and valve block, with tommy.
Ring, metal, guide, leather packing.

		ft.	in.
Height	Carriage at centre of trunnions..........	3	11·5
	Platform	3	0·5
	Total	7	0·0

Brake Gear.

PLATES III. & IV.

The running up is controlled by a differential brake with two bands fitting in the recesses *c c* on the buffer cylinder. These bands are attached to levers, *a*, which are so arranged that on recoil the bands loosen on the cylinder and offer no resistance to the movement of the carriage; but directly the carriage begins to run up, the bands automatically tighten, and retain it in the loading position until released by the lever *b*.

The bands are fitted with adjusting screws to regulate their tension, which should be just sufficient to retain the carriages on recoil.

Running Back Gear.

PLATE III.

Running back is effected by the winch handle, *c*, on the left side, acting through a train of wheels, *d*, which gear into the teeth on the buffer. This is thrown in and out of gear by means of a clutch, worked by the handle, *e*.

		Front. ft.	Front. in.	Rear. ft.	Rear. in.
Radii of racers	A	5	0	16	6
	C	6	1	6	1
	E	10	8·25	2	2
	F	12	10	2	2

	Weight.	Tonnage.
Carriage	34¾ cwt,	2·234 tons.
Buffer	9¾ ,,	—
Platform (with buffer and derrick)	69¾ ,,	4·467 ,,

General Instructions for Care and Preservation.

Care should be taken that all nuts and screws are properly tightened up; on no account should a hammer be used in doing this.

A nut, screw, or bolt if removed should be slightly oiled before being replaced, and a few turns should be given by hand before employing the spanner, to prevent damage by the threads crossing. All bright parts should be kept clean and slightly oiled.

The working parts should be kept free from clotted oil, dirt, and corrosion, and well lubricated through holes provided for the purpose; care should be taken to replace the small screws in the lubricating holes.

5 ft. 6 in. Parapet.

To fill the buffer:—Run the carriage up, remove the filling hole plug, and by means of the gallon measure run in 5 gallons of fluid; replace the plug. As the quantity of fluid in the buffer is liable to diminish from various causes, care should be taken before firing that the depth of the fluid at the filling hole is in accordance with that given on the inscription plate. If the buffer leaks at the gland, and tightening up the latter does not remedy it, the packing must be renewed.

To renew the packing:—Run the carriage up, empty the buffer, unscrew the gland with the "spanner, hydraulic buffer, No. 3," and extract the defective packing. Well tallow the fresh packing, insert it in the stuffing box, and replace the gland.

6 ft. Parapet.

Before firing, see that the buffer is filled with fluid; a plate with the necessary instructions for filling is fitted to the cylinder, F.

The running back arrangement should be thrown out of gear by disconnecting the clutch *every time* it is used during action. The buffer should always be kept filled with fluid. Leakage from the buffer is likely to occur if the packing leathers become dry and out of proper adjustment. This defect may be remedied by running the carriage in and out as quickly as possible; if this does not answer, the leathers must be removed and well moistened, and suppled with Russian tallow. The recesses of the leathers must be filled with tallow before replacing.

If the buffer still leaks badly the packing leathers must be renewed; this will necessitate the removal of the buffer, which is done as follows:—Unbolt the clips on the bottom plate, disconnect the differential levers and brake bands; remove the caps from the buffer spindle, and raise the carriage (with levers, handspikes, and

skidding, or a jack) out of gear with the buffer; then with suitable tackle remove the buffer and place it in a convenient position for unscrewing the metal gland rings with the "wrench No. 1" supplied.

The gland rings are cut with a right and left hand thread respectively, and unscrew when turned towards the front.

As it is of the utmost importance that the leather packing should be placed in position without injury, a "ring, metal, guide leather packing" is provided, by means of which the leather can be slipped on without damage. Before placing the leathers, well grease them, and fill the recesses with Russian tallow. After adjusting the leather replace the gland rings.

The valve should on no account be tampered with, but if it is required to renew the leather packing in consequence of leakage, the valve should be withdrawn as a whole (by means of the "wrench No. 2" provided), fitted with a fresh leather which has been well greased with tallow, and replaced.

When returning the buffer, observe that the spindle is placed in its bearings according to the stamped directions on each end ("top right" and "top left") and that the teeth on the cylinder, F, and rack, respectively marked "starting tooth," gear together. Secure the buffer in position by the caps, connect the differential levers and brake bands, and bolt the clip plates on the carriage. The carriage should then be worked by the running back gear, to ascertain that the buffer is in correct gear with the carriage rack.

PROJECTILES.

(*List of Changes*, §§ 3172, 3717, 3899, 4083, 5370.)

PLATE VIII.

		Weight lb. oz.
Shells, Common, Mark VI..	empty	57 6
	filled with 7 lb. 2 oz. bursting charge	64 11
Shells, Shrapnel, Mark VII.	filled with 234 mixed metal bullets, 14 per lb., and 9 oz. bursting charge	67 7
Shot, case, Mark V., filled with 50 8-oz. sand shot, clay and sand..		49 14½

Spherical projectiles are not in future to be fired from rifled guns.

Common shells are used on land fronts against earthworks, buildings, &c.; on sea fronts against shipping.

Shrapnel shells are used when the range is beyond the effective power of case shot; on land fronts against bodies of troops; on sea fronts against boats.

Case shot is used for close quarters against troops or boats. Two : be used on emergencies at close quarters. This projectile is interchangeable for the 80-pr. gun and 6·3-in. howitzer.

Fuzes.

Plates IX. and X.

Percussion, Royal Laboratory No. 7.
Time, wood, 15-seconds M.L. No. 41 (Mark II.).

R.L. Percussion Fuze.

Plate X.

This fuze consists of a body, needle, guard, pellet with cap, base plug, and safety pin.

The body is of gun-metal, it is tapped on the exterior to the G.S. pitch and taper, and on the interior at the bottom to receive a screw-plug also of gun-metal. On the top is a square keyhole recess of proper size to take the "Key, plug, G.S." or "Key, fuze, Universal."

From the lower surface of the head projects a steel needle.

Inside the body is a gun-metal guard recessed as shown in the plate, and supported in position by two feathers on the exterior circumferences of pellet.

The pellet is made of lead and tin in equal proportions, and has a bevelled edge above the feathers corresponding to a similar recess in the interior surface of the guard.

The pellet is hollow and is cupped out to receive a copper cap containing about $3\frac{1}{2}$ grains of cap composition, pressed and varnished in the same way as ordinary percussion caps. The upper part of the pellet is covered by a copper cap, attached by three indentations, to protect it from being damaged by the safety pin when jolted in the limbers, thereby allowing the detonating composition to approach dangerously near to the point of the needle.

The safety of the fuze in transit, &c., is ensured by a safety pin made of twisted brass wire, which has a tarred twine becket wherewith to pull it out at the moment of loading.

When the safety pin is withdrawn, the hole through which it passed is closed by a small lead pellet which sets back across it.

The bottom plug screws in the bottom of fuze. It has a fire-hole drilled through its centre which is closed by a thin brass disc secured by spinning over.

Action.

On discharge, the guard sets back, shearing the feathers; the pellet is then free to move forward on to the needle on impact.

Instructions for the Preparation of Shells and Fuzes, and Examination of Filled Shells.

Filling and Securing Shells.

Common Shells.

Remove the plug from the fuze-hole, place the filling-rod in the bag, insert it through the fuze-hole, taking care not to force the end of the rod through the bottom of the bag; carefully push in the bag until the neck only is in the fuze-hole, a portion being kept outside, as the whole bag must not be allowed to slip into the shell during the operations of filling: then withdraw the rod and insert the funnel in the neck of the bag, pressing the funnel well down into the fuze-hole; pass the filling-rod down through the funnel and gradually pour in two or three pounds of powder; take out the funnel and rod, lift up the bag and jerk it, so as to "set" the powder well down to the bottom and to open the bag. Then re-insert the funnel and rod as before and continue the filling.

The filling-rod should be moved up and down to facilitate the passage of the powder through the funnel; the powder should be firmly pressed upon all over, and the rod should not be forced against the bag, a steady pressure is necessary to fill the shell, and this should be frequently applied; no great amount of force should be used.

When the shell is quite full, withdraw the funnel and filling-rod and tie the neck of the bag with twine close to the top of the fuze-hole. A piece of twine is attached to the neck of the bag for this purpose; it must be shifted to its proper position if necessary. Cut off the superfluous choke and push the neck of the bag well down, and to one side of the fuze-hole; insert in every shell one "Bag, primer, filled, 7 drams." or more if there is room, then screw in the fuze or plug as required, taking care that the fuze-hole is clean and the fuze or plug lubricated.

Common Shell filled with P. and F.G. Powder.

The bag having been inserted in the shell and the proportions of P. and fine-grain powders (2 lbs. P., then 5 ozs. F.G.*) weighed out, one portion of the former is dropped into the shell pebble by pebble, after which the copper funnel is inserted and the proportion of fine-grained powder poured in. The whole is then lightly stirred and pressed with the filling rod, and the operation repeated until the shell

* F.G., Pistol, R.F.G., R.F.G.[2], or Service L.G. powder, will be employed according to convenience of stock, but the last-mentioned nature only in cases of emergency.

is filled. The neck of the bag is then tied up and the superfluous choke cut off and the neck pushed to one side of the fuze-hole; insert one or more "Bags, primer, filled, 7 drams," then screw in the fuze or plug as required, taking care that the fuze-hole is clean and the fuze or plug lubricated.

The bursting charge of P. and F.G. is $8\frac{1}{2}$ lbs. P. and $1\frac{1}{4}$ lb. F.G.; but the use of the mixture is not yet sanctioned for land service.

Shrapnel Shells.

Remove the plug from the fuze-hole, and after seeing that the fuze-hole is clear of any dirt, &c., insert the leather funnel and pour in the bursting charge (Pistol, F.G., R.F.G., or R.F.G.[2] powder) which has been previously weighed or measured. This must be done gradually, for if the whole of the powder is put in at once the tube will probably become choked. The shell should be tapped on the side with a mallet until the whole of the bursting charge has passed down the tube, taking care that none of the powder is left at the bottom of the socket. Drop in the primer shrapnel shell, and by means of the driver, screw, shrapnel, large, Mark III., screw it tightly into the tube, and then screw in the fuze or plug as may be required.

Fixing Plugs and Fuzes.

When plugs or metal fuzes are screwed into shells they will be lubricated with Field's grease, No. 3, for stations at home or in B.N. America; for other stations Price's composite grease is to be used.

Instances have occurred in which fuze-hole plugs of common shells have been so jammed in as to be immovable, in consequence of using the "Wrench, base plugs." The "key, fuze, and plug, G.S." and the "key, plug, G.S." or "key, fuze, universal" are the only implements which should be used for screwing in the G.S. plug.

Distinguishing Marks.

All shrapnel shell will be painted with a red tip, 1 inch deep.

All filled shell will have a red band $\frac{1}{2}$ inch wide, painted round the head; in the case of steel shell this band will be immediately below the white band, and in the case of cast-iron shrapnel this band will be $\frac{1}{2}$ inch below the red tip. They will also be marked with the date of filling, and also the monogram of the station, except when filled by the Royal Artillery.

Filled shell will be marked with the word "Bag" if a bag is used, and with a red disc, 1 inch diameter, if shalloon primers have been inserted, and the letter "P" if filled with P and fine-grain mixture.

The colour of the paint will be red on a black ground, and black on a red ground.

Projectiles which are to be used for practice only will be marked with a yellow band round the body.

Shells which have been emptied will be marked on the head with the letter "E" in red paint.

Preparing Fuzes.

Fuzes, Time, 15", M.L.

These fuzes are prepared for any desired time of flight by boring through the side-hole corresponding to the required time into the composition.

When using the hook-borer place the fuze in the hook of the hook-borer in the proper position for boring the required hole; enter the bit into the side hole, screwing up until the bit has entered as far as the borer will allow, taking care to press the fuze with the fingers so as to ensure its bedding fairly in the hook.

Unscrew, and when the bit is quite clear remove the fuze from the hook. The length of the bit is so regulated that, when placed in the handle, it will enter sufficiently far into the composition when screwed down to the shoulder. If the bit should become unserviceable the handle must be detached from the shank and the tightening-screw unscrewed, the square hole in the hook being made for that purpose. Care must be taken when substituting another bit that it is properly placed in the handle, and that the tightening-screw firmly presses upon it, for if any space be left between the handle and the head of the bit, the end will not enter a sufficient depth into the composition. The borer should be occasionally examined and cleaned. The operation of preparing the fuze and fixing it in the shell takes on an average about 15 seconds; with a little practice these operations may be performed in a shorter time.

Fixing Fuzes.

Fuzes, Percussion, R.L.

These fuzes require no preparation, except the removal of the safety-pin; they are screwed firmly into the fuze-hole by means of the "Key, fuze and plug, G.S.," or "Key, fuze, universal."

Fuzes, Time, M.L.

These fuzes are fixed in the fuze-hole by screwing the fuze round by hand until it is held firmly in the fuze-hole; the fuze must not be uncapped until the shell is placed in the muzzle of the gun. These fuzes are "uncapped" by taking hold of the small end of the copper band, which is left exposed, and unwinding from left to right smartly, so as to thoroughly detach the band from the head of the fuze and to leave the priming fully exposed.

Extracting Wood Fuzes.

Apply the fuze-extractor to the head of the fuze and unscrew.

Examination of Filled Shells.

Caking of Powder from Effects of Damp.

Whenever it may be considered necessary to examine the interior of filled shells for rifled ordnance, and it is found that the powder is caked from the effects of damp, the shells, with the exception of the shrapnel, will be emptied, cleaned out, and refilled; the shrapnel will be exchanged.

Common Shells Filled with Powder in Serge Bags.

Remove the plug (in the case of shells containing the "Bags, primer," remove the bags with the "Hook, G.S., wads"); draw out the neck of the serge bag by means of the above hook, and untie the twine round the neck of the bag. If the powder is in a serviceable condition, tie up the neck of the bag again, and proceed as directed in the instructions for filling. If the powder is caked from the effects of damp, empty the shell (this requires careful manipulation); up-end the shell as required, insert the filling rod or any suitable sized piece of brass wire, so as to facilitate the exit of the powder and to prevent the bag doubling up, &c., until the whole of the powder is extracted. Take out the bag, and if it is in a serviceable condition replace it in the shell; if not, insert a new bag, and refill with serviceable powder, the bags, primer, if serviceable, being also replaced. If the powder is so caked that it will not run out of the shell, fill the shell with boiling water and allow it to stand for about 5 minutes, then pour out the water and fill up again with boiling water. After standing for 15 minutes more, the shell may be emptied, using the copper scraper for shells to facilitate the removal of the wetted powder. The scraper must not be applied until after 15 minutes have elapsed after the second quantity of boiling water has been poured in. When the shell is perfectly dry refill with serviceable powder.

Shrapnel Shells.

Remove the fuze-hole plug, unscrew the primer with the "Driver screw, shrapnel, large, Mark III.," and lift out the primer with the "Pincers, shrapnel, primers;" turn the shell nose downwards, and if the powder charge flows out and is serviceable, refill and replace primer and plug; the shell should be well shaken if the powder does not come out quite freely, as a portion of the powder may possibly be jammed in the tube; if the powder cannot be extracted as above (being caked from the effects of damp, &c.), the primer and plug will be replaced, and steps taken for the exchange of the shell.

Charges.

Full { Marks I. and II., $6\frac{1}{2}$ lb. R.L.G.[4], Mark I.
Full { Mark III., 10 lb. R.L.G.[4], Mark I.
Saluting, Marks I., II., and III., 5 lb. Blank.

Directions for Making up Cartridges.

Filling.

Care will be taken to see that the empty cartridges are thoroughly dry before being filled, and the proper charge will be carefully weighed out, and inserted in the bag by means of the "funnel, copper, cartridge."

The cartridges will be choked by drawing together the mouth of the cartridge into several plaits with a nickel silver needle, threaded with three strands of worsted for serge cartridges, or with two strands of silk twist for silk cloth cartridges; after drawing together the mouth of the cartridge, three turns will be taken round the plaits, and the choke thus formed will be further secured by passing the needle three times through it alternately above and below the turns, thereby stitching down the turns round the choke at two points equi-distant from each other.

The cartridges will be made up to their proper lengths and diameters by means of the hoops, which should be drawn tight, so as to make a firm cartridge.

Hooping—

With braid hoops.—Draw the braid through the serge or silk cloth until the knot of the loop comes home to the serge or silk cloth, the single end being already passed through the loop from underneath, pass the single end to one side of and under the loop, then draw the hoop tight and keep it so by placing the forefinger of the left hand firmly on the loop: bring the running end between itself and the loop, and draw tight the single bend thus formed, *taking care that the bend bites on the loop and not on the single end,* otherwise the knot will slip. The maintenance of the proper form of the cartridge depends on the hooping being thus secured;

With worsted or silk twist.—After making the last stitch in choking, the needle will be turned downwards and carried through the powder and out at the seam in the line for the front hoop, the worsted or silk twist will then be carried tightly round the cartridge so as to form a hoop, and will be stitched to the cartridge at two or three points in the same way as the turns at the choke were secured, and the remainder of the hoops will then be similarly formed.

Marking Filled Cartridges.

All filled cartridges will have the initial or monogram of the station at which they are filled, stamped on the bottom end.

The cartridges filled by the Royal Artillery will be distinguished

by having no initial letter stamped on them. This order does not apply to cartridges filled by working parties of Royal Artillery for the Ordnance Store Department.

The following initials and monograms will be used at the several stations mentioned :—

Home Stations.

Alderney	A	Dublin	DN	Pembroke	P
Aldershot	AT	Edinburgh	E	Sheerness	S
Chatham	C	Fort George	FG	Tynemouth	T
Chester	HCR	Gosport	G	Upnor	U
Cork	HCK	Guernsey	GY	Woolwich	W
Devonport	D	Harwich	H		
Dover	VR	Jersey	J		

Foreign Stations.

Barbadoes	BS	Hong Kong	HK
Bermuda	B	Jamaica	CJA
Cape Town	CT	Kingston, Canada	K
Ceylon	CN	Malta	M
Gibraltar	GIB	Mauritius	HMF
Halifax, N.S.	H	Quebec and Montreal	Q

Finished Cartridges.

All cartridges will be very carefully examined and gauged as to length and diameter previous to packing.

Drill Cartridges.

Drill cartridges are a special manufacture and are issued complete; they are of wood, covered with raw hide, and made to the shape of the cartridge they represent.

Range Tables.

Charge, 6¼ lb. R.L.G.^{4} for Marks I. and II.; gravimetric density $\frac{29 \cdot 0}{0 \cdot 990}$.*

Projectile, common shell, weight 65 lb.

Muzzle velocity, 1,125 f.s.

Mounting, wood garrison.

Jump, 13 minutes.

* The shell should be rammed to 6·4 inches from the bottom of the bore.

Range.	Elevation.	Angle of descent.	Slope of descent.	Remaining velocity.	Time of flight.	Fuze Scale. 15-seconds M.L. wood time fuze.	
yards.	° ′	° ′	1 in	f. s.	seconds.	yards.	fuze.
0				1125		175	0·5
100	—	0 13	270	1103	0·27	245	1·0
200	0 13	0 27	127	1082	0·54	310	1·5
300	0 26	0 41	84	1063	0·82	380	2·0
400	0 40	0 56	61	1046	1·20	445	2·5
500	0 54	1 11	48	1031	1·38	515	3·0
600	1 8	1 27	40	1017	1·67	580	3·5
700	1 22	1 43	33	1005	1·97	650	4·0
800	1 37	2 0	29	993	2·28	715	4·5
900	1 52	2 17	25	981	2·59	785	5·0
1000	2 7	2 35	22	969	2·91	850	5·5
1100	2 22	2 53	20	958	3·23	920	6·0
1200	2 37	3 12	18	947	3·55	985	6·5
1300	2 53	3 32	16	936	3·87	1050	7·0
1400	3 9	3 53	15	925	4·20	1115	7·5
1500	3 25	4 15	13	915	4·53	1180	8·0
1600	3 42	4 37	12	905	4·86	1245	8·5
1700	3 59	5 0	11	895	5·19	1310	9·0
1800	4 17	5 24	11	885	5·53	1375	9·5
1900	4 35	5 48	9·8	875	5·87	1440	10·0
2000	4 53	6 13	9·2	865	6·21	1505	10·5
2100	5 12	6 39	8·6	856	6·56	1570	11·0
2200	5 31	7 6	8·0	847	6·91	1635	11·5
2300	5 51	7 34	7·5	838	7·27	1700	12·0
2400	6 11	8 3	7·1	829	7·63	1760	12·5
2500	6 33	8 33	6·7	821	7·99	1825	13·0
2600	6 54	9 3	6·3	813	8·36	1885	13·5
2700	7 16	9 34	5·9	805	8·73	1950	14·0
2800	7 38	10 5	5·6	797	9·10	2010	14·5
2900	8 1	10 37	5·3	789	9·48	2075	15·0
3000	8 24	11 10	5·1	781	9·86	2135	15·5
3100	8 47	11 43	4·8	773	10·25	2200	16·0
3200	9 11	12 17	4·6	765	10·6	2260	16·5
3300	9 36	12 52	4·4	757	11·0	2325	17·0
3400	10 2	13 27	4·2	750	11·4	2385	17·5
3500	10 28	14 3	4·0	743	11·8	2450	18·0
3600	10 55	14 40	3·8	737	12·2	2510	18·5
3700	11 22	15 17	3·7	730	12·6	2570	19·0
3800	11 50	15 55	3·5	723	13·0	2630	19·5
3900	12 19	16 34	3·4	716	13·4	2690	20·0
4000	12 48	17 14	3·2	709	13·8	2745	20·5
						2805	21·0
						2860	21·5
						2920	22·0
						2975	22·5
						3030	23·0
						3085	23·5
						3140	24·0
						3195	24·5
						3250	25·0
						3305	25·5
						3360	26·0
						3410	26·5
						3460	27·0
						3510	27·5
						3560	28·0
						3610	28·5
						3660	29·0
						3710	29·5
						3770	30·0

Charge, 10 lb. R.L.G.[4] for Mark III. gun.

Projectile, common shell, 65 lb.

No jump.

Muzzle velocity, 1,390 f.s.

Range.	Elevation.	Angle of descent.	Remaining velocity.	5 minutes elevation increases or decreases the range by	5 minutes will alter point of impact vertically or laterally at each range.	Time of Flight.	15-seconds' Fuze scale.	
yards.	° ′	° ′	f.s.	yards.	yards.	seconds.	range.	fuze.
0								
100	0 9	0 9	1353	64	0·14	·23	100	1·0
200	0 17	0 18	1318	61	0·29	·46	200	1·5
300	0 26	0 27	1285	58	0·43	·69	300	2·0
400	0 34	0 37	1254	56	0·58	·92	390	2·5
500	0 43	0 47	1225	54	0·72	1·16	480	3·0
600	0 53	0 58	1198	52	0·87	1·40	570	3·5
700	1 3	1 10	1172	50	1·01	1·65	660	4·0
800	1 13	1 23	1147	48	1·16	1·90	750	4·5
900	1 24	1 37	1124	46	1·31	2·15	830	5·0
1000	1 35	1 52	1101	45	1·45	2·40	920	5·5
1100	1 46	2 7	1080	43	1·60	2·66	1000	6·0
1200	1 58	2 23	1060	42	1·74	2·92	1080	6·5
1300	2 10	2 40	1044	41	1·89	3·19	1160	7·0
1400	2 22	2 58	1029	40	2·03	3·46	1240	7·5
1500	2 35	3 16	1015	39	2·18	3·74	1320	8·0
1600	2 48	3 35	1002	37	2·32	4·02	1400	8·5
1700	3 2	3 55	989	36	2·47	4·30	1480	9·0
1800	2 16	4 15	977	35	2·61	4·58	1560	9·5
1900	3 31	4 36	965	34	2·76	4·87	1630	10·0
2000	3 46	4 58	954	33	2·91	5·16	1710	10·5
2100	4 1	5 20	944	32	3·05	5·45	1790	11·0
2200	4 17	5 43	933	31	3·20	5·74	1870	11·5
2300	4 33	6 7	922	30	3·34	6·03	1940	12·0
2400	4 49	6 31	912	29	3·49	6·32	2020	12·5
2500	5 6	6 56	902	29	3·63	6·61	2100	13·0
2600	5 23	7 21	892	28	3·78	6·91	2170	13·5
2700	5 41	7 47	882	28	3·92	7·21	2250	14·0
2800	5 59	8 14	872	27	4·07	7·52	2330	14·5
2900	6 17	8 41	863	27	4·21	7·84	2400	15·0
3000	6 35	9 9	854	27	4·36	8·17	2470	15·5
3100	6 54	9 38	845	26	4·51	8·50	2540	16 0
3200	7 13	10 7	836	26	4·65	8·83	2610	16·5
3300	7 32	10 37	828	25	4·80	9·16	2680	17·0
3400	7 52	11 7	820	25	4·94	9·49	2750	17·5
3500	8 12	11 38	812	25	5·09	9·83	2820	18·0
3600	8 32	12 10	804	24	5·23	10·17	2890	18·5
3700	8 53	12 43	796	24	5·38	10·52	2960	19·0
3800	9 14	13 16	788	23	5·52	10·87	3030	19·5
3900	9 35	13 50	780	23	5·67	11·23	3100	20·0
4000	9 56	14 25	772	23	5·81	11·60	3170	20·5
							3240	21·0
							3300	21·5
							3360	22·0
							3420	22·5
							3480	23·0
							3540	23·5
							3600	24·0
							3660	24·5
							3720	25 0
							3780	25·5
							3840	26·0
							3900	26·5
							3960	27·0

Drill for 64-pr. R.M.L. Guns, on Common Standing Carriages.

The detachment consists of nine numbers and falls in two deep.

To Tell Off

Officer.	*No. 1.*
Tell off.	

At "Tell off," No. 1 (who is on the left of the detachment) takes a pace to his front, turns to his right, and numbers himself 1, the right-hand man of the rear rank numbers 2, the right-hand man front rank 3, the second man from the right of the rear rank 4, the man in his front 5, and so on; after the detachment is told off No. 1 falls in again on the left of the front rank.

The detachment is marched into the battery and halted in line facing the parapet, and to the left rear of the platform. The detachment is now in position of "detachment rear."

To Take Post under Cover.

Officer.	*No. 1.*
Take post under cover.	Right turn. Double march.

The detachment stepping off, wheels to its left at the left corner of the platform; the front rank filing to the left of the gun, the rear rank to the right, 2 and 3 halting close to the parapet and near the embrasure; 4 and 5 forming upon their right and left, and the whole turning to the right-about together. No. 1 follows in rear of the detachment, and at drill forms up on the right of No. 5; 6 and 8 go to the cartridge store (6 outside), and 7 and 9 to the shell store (7 outside).

General Duties.

No. 1 commands, directs, or superintends boring and fixing fuzes, directs the gun into the line of fire in running up, and lays.

No. 2 searches, sponges, rams home, runs up, elevates and traverses.

No. 3 loads, uncaps or removes safety pin from fuze when in the bore, rams home, runs up, elevates, and traverses.

No. 4 attends to side arms and supplies them to 2, runs up and attends to the elevating screw and coin in laying.

No. 5 attends to vent, runs up, makes ready and fires.

No. 6 supplies 3 with cartridges.

No. 7 attends to fuzes and brings up projectiles.

No. 8 attends to cartridge store and serves out cartridges to 6.

No. 9 attends to shell store, issues shells, tubes, and fuzes.

To Prepare for Action.

Officer.	*No. 1.*
Prepare for action.	Prepare for action. Examine gun.

"Prepare for action."

The stores are brought up as follows:—

No. 1, handspike, sights, and a piece of chalk.*

No. 2, handspike and assists 4 with side arms.†

No. 3, handspike and elevating screw, removes the tampeon from the muzzle.

No. 4, handspike, side-arms, and support for heads of side-arms.

No. 5, handspike, tubes in box, lanyard, pricker, and vent-server.

No. 6, two cartridge cases, which he leaves at the cartridge store, bucket filled and brush (two drill cartridges for drill purposes).

No. 7 fuzes, fuze and shell implements. He obtains the fuze boxes from 9, having ascertained from No. 1 the nature of fuzes required; he sees that fuzes and fuze implements are correct.

No. 8 prepares to issue cartridges.

No. 9 provides a brush for cleaning shell, prepares to issue shells, friction tubes, and fuzes, after which he examines the shells carefully, cleaning them if necessary, and removing burrs from studs; he loosens the fuze-hole plugs of shells that will be first issued.

The stores having been brought up, No. 1 will satisfy himself that the foresights fit properly on the gun, that the deflection leaves of the hind sights work easily, and that the platform is properly swept; he receives reports from the Nos. responsible of any irregularity or deficiency in connection with the gun, ammunition, or stores.

The sponge and rammer are laid on the ground clear of the platform, to the right of the gun and parallel to it, heads to the rear, resting on the support supplied by 4, sponge nearest the gun; the

* 6-foot handspikes are used with this gun.
† See para. 3718, List of Changes.

shell extractor and wad hook so as not to interfere with the working of any of the guns in the battery, and convenient for the guns for which intended. The sponge bucket near the sponge head.

The handspikes are laid down, two on each side of the platform close to the carriage, points to the front, bevelled side uppermost; those of 2 and 3 outside and about 2 feet in advance of those of 4 and 5. No. 1's handspike in rear of the platform.

No. 3 examines the bore to see the grooves are free from grit, &c.

No. 4 sees that the elevating screw is properly oiled.

No. 5 straps the tube box round his waist on the right side, coils up the lanyard, and passes the bight of it under the tube box strap, places the pricker in the loop on the side of the carriage, examines the vent-server and places it in the vent, the loop of the vent-server lanyard over one of the sights, he fills his box with friction tubes, which he procures from 9.

If the gun is to be prepared for drill only, 8 and 9 provide and hook a tackle to the rear axletree and to a holdfast in rear of the gun.

The gun is supposed to be at the rear of the platform.

"Examine gun."

No. 5 drifts the vent, replaces the pricker in the loop and the vent-server.

No. 2 supplies himself with the wad hook, searches the gun after the pricker is withdrawn, and replaces the wad hook.

Nos. 4 and 5 take a purchase with handspikes over the cheeks and under the breech, the coin is withdrawn and the elevating screw put in by 3, No. 1 holding up the stool bed with a handspike applied over the bottom step of the carriage. No 1 gives the order "Lower," 4 and 5 withdraw their handspikes, and lay them down.

To Load.

Officer.	*No.* 1.
Range——yards. With——load.	With——load.

"Load."—No. 1 gives 7 the nature of shell and fuze required, and during the loading fixes his tangent scale at the required elevation and places himself where he can best superintend the service of the gun.

No. 2 places himself in a convenient position for sponging. He places his left foot in line with and about 12 inches from the muzzle, steps to his right with his right foot and looks to his left rear, takes the sponge in a horizontal position from 4, left hand back down, right hand back up, brings it in line with the axis of the gun, enters the head into the bore, being careful to observe that the vent-server is in the vent, slides his hands along the stave to his right as far as he can reach, sends the sponge up the bore, slides his hands out again and forces the sponge hard home, gives it two half turns, pressing it against the bottom of the bore, withdraws the sponge hand over hand, turning it from him cleaning the bore well. When the sponge

arrives near the muzzle he jerks it out, his hands then should be in the position they were in when he introduced the sponge into the bore. He then hands the sponge to 4 and receives the rammer, right hand about the centre back down, left as near the head as possible back up; as soon as the cartridge and shell are put in, he enters the head into the bore and forces them home hand over hand. He then springs the rammer, steps out, hands it to 4 and goes under cover.

No. 3, as soon as the sponge is withdrawn, takes the cartridge from the cartridge case with his left hand, moves up and places it in the bore, he then slews his body to his right and receives a shell from 7 and puts it in the bore, withdraws the safety pin, or uncaps the fuze, places himself in a corresponding position to 2 and assists him to ram home; when the cartridge and projectile are home he quits the stave and goes under cover. Should it appear by the mark on the rammer that the charge is not home, 2 and 3 ram home again.

No. 4 doubles out, halts in line with the sponge head, turns to his left, picks up the stave with his right hand back under, six inches from the head, turns three-quarters left about, and in doing so lifts the sponge over his head, allowing the end of the stave to rest on the ground. His left hand meets the stave close to the sponge, his right hand is slipped up the stave about two feet. He then moves towards the muzzle and passes the stave into the embrasure in such a manner that 2 can conveniently lay hold of it, waiting at the left rear of 2, facing the gun to receive the sponge. When he receives the sponge from 2, he allows the end of the stave to fall on the platform, steps to his left, turns three-quarters right about, passing the sponge over his head, lays it down, takes up the rammer as before detailed for the sponge, and hands it to 2. He then remains in position to receive the rammer, which he does as soon as 2 has sprung it. He lays it down as he did the sponge and goes under cover.

No. 6 brings up a cartridge in a case and places it on the ground on 3's right front; after the sponge is withdrawn he uncovers it, and as soon as 3 has withdrawn the cartridge, he goes back to the cartridge store.

No. 7 brings up a shell, point to his right, having fixed the fuze, according to No, 1's directions, and hands it to 3.

No. 8 issues a cartridge to 6.

No. 9 issues a shell to 7.

To Run Up.

Officer.	*No. 1.*
	Run up. Halt.

Directly the gun is loaded, No. 1 gives "Run up" and applies his handspike under the rear axletree to guide the gun.

Nos. 2, 3, 4, 5 take up their handspikes at the centre with the

hands, next the parapet back up, the other hands at the small ends back down, stepping up to their respective axletree arms, they apply their handspikes under and in rear of them and stand ready to heave, taking the time from 2, and using short quick purchases they heave together until the front trucks nearly touch the hurter, when No. 1 gives "Halt," slides his handspike to the rear, clear of the recoil, and looks over the sights, steadying himself by leaning on the cascable.

Nos. 2, 3, 4, and 5 withdraw their handspikes, drop the points to the ground; 4 and 5 lay theirs down; 2 and 3 turn to the rear and step outwards, holding their handspikes diagonally across the body, outward hands at the small ends as high as the ear, inward hands resting on the handspike at the full extent of the arm, bevelled side of the handspikes uppermost; 4, kneeling on his left knee in rear of the right cheek, takes hold of the large coin with both hands, or the small coin with his left hand, or works the screw as may be directed by No. 1; the screw should be used only for final adjustment; 5 goes under cover and prepares a tube.

To Lay, Make Ready, and Fire.

Officer.	*No.* 1.
Commence firing, or Fire——rounds.	Elevate. Lower. Coin. With screw, Elevate. Halt. Depress, Halt. Trail (right). Halt. Trail (left). Halt. No.——Ready. No.——Fire.

No. 1, looking over his sights, gives "Elevates," then "Lower," and when the gun is at the required elevation "Coin." If a slight amount of elevation or depression is required, he gives "With Screw," "Elevate," or "Depress."

"Elevate." 2 and 3 step forward in line with the breech, place their handspikes, bevels down, over the steps and under the breech, and bear down; at "Lower," they allow the small ends to rise gently; at "Coin" they withdraw their handspikes and step outwards; 4 withdraws the coin as soon as 2 and 3 elevate, and at "Coin" forces it sharply home. If the order is "With Screw," "Elevate," or "Depress," 4 works the screw until "Halt" is given. The other numbers stand fast.

If the muzzle is to go to the left No. 1 gives "Trail right," and when the muzzle is sufficiently to the left, "Halt." At "Trail right" 2 moves round on his right foot to the rear of the axletree arm and applies his handspike under it to row; 3, stepping to his left, takes a purchase under the rear of the cheek and stands ready to heave over the trail. They heave together until the order "Halt," and remain there steady till the next order is given.

"Trail left" is the converse of the above. If much traversing is required the order is "Extreme right" or "Extreme left." In this case 4 or 5, according to the side, takes a purchase in front of the rear truck in addition to the other numbers.

Should no order to fire be given when the gun is laid, No. 1 will give the word "Under cover."

No. 1 lowers his tangent scale, except when firing at a moving object, and gives "Ready;" 5 presses the tube into the vent with his right thumb, steps clear of the recoil, shifts the lanyard to his right hand and extends it, facing the gun.

As soon as "Ready" is given, 2 and 3 lay down their handspikes and with 4 go under cover, except when firing at a moving object.

At the word "No. — " (naming his gun) from No. 1, 5 stretches the lanyard, looking towards No. 1.

At "Fire," 5 draws the lanyard strongly towards his body, without a jerk; he then drifts the vent, replaces the vent-server and pricker, and goes under cover, replacing the lanyard under his belt.

No. 1 does not again give "Load" until 5 has replaced the vent-server.

To Run Back and Unload.

Officer.	*No.* 1.
	Run back. Halt. Unload.

When the vent has been drifted and the vent-server placed in the vent, at "Run back" the detachment double out and man the fall of the tackle arranged by 8 and 9 for the purpose, and heave the gun back into the position for loading, No. 1 giving "Halt," "Unload," when the gun is sufficiently run back. On this order the gun is unloaded, 2 and 3 withdrawing the charge, 4 supplying the necessary side-arms.

To Cease Firing and Replace Stores.

Officer.	*No.* 1.
Cease firing. Replace stores.	Elevate. Lower. Coin. Replace stores.

"Cease firing," "Replace stores," No. 1 gives "Elevate," and the gun is laid under metal by 4 and 5; he then gives "Replace stores," and the stores are replaced by the numbers who brought them up.

To Form Detachment Rear.

Officer.	*No. 1.*
Detachment rear.	Outwards turn. Double march. Halt. Front.

"Detachment rear."—No. 1 doubles to the left rear of the platform, turns to the left, and gives the order "Outwards turn;" 2 and 4 turn to their left, 3 and 5 to their right.

"Double march."—4 and 5 followed by 2 and 3 wheel to the right and left, and when clear of the platform to the right, and round No. 1's left shoulder, 6, 7, 8, and 9 coming up into their places; when 2 and 3 have passed him No. 1 gives "Halt," "Front," and changes his flank by the rear.

To Change Rounds.

Officer.	*No. 1.*
Change rounds.	Change rounds.

In changing rounds No. 2 becomes 4; 4, 1; 1, 9: 9, 8; 8, 7; 7, 6; 6, 5; 5, 3; 3, 2.

Drill for 64-pr. R.M.L. Gun, mounted on 6-ft. Parapet Carriage and Platform.

The detachment consists of nine numbers and falls in two deep.

To Tell Off.

Officer.	*No. 1.*
Tell off.	

At "Tell off," No. 1 (who is on the left of the detachment) takes a pace to his front, turns to his right, and numbers himself 1; the

right hand man of the rear rank numbers 2; the right hand man front rank, 3; the second man from the right of the rear rank, 4; the man in his front, 5; and so on; after the detachment is told off No. 1 falls in again on the left of the front rank.

The detachment is marched into the battery and halted in line facing the parapet, and to the left rear of the platform. The detachment is now in a position of "detachment rear."

To take post under cover.

Officer.	*No.* 1.
Take post under cover.	Right turn. Double March.

The detachment stepping off wheels to its left at the left corner of the platform; the front rank filing to the left of the gun, the rear rank to the right, 2 and 3 halting close to the parapet, 4 and 5 forming upon their right and left, and the whole turning to the right-about together. No. 1 follows in rear of the detachment, and at drill forms up on the right of No. 5; 6 and 8 go to the cartridge store (6 outside) and 7 and 9 to the shell store (7 outside).

General Duties.

No. 1 commands, directs. or superintends boring and fixing of fuzes, adjusts the buffer to the charge used, ascertains that the buffer contains the proper amount of oil, and lays.

No. 2 searches, sponges, rams home, runs back when necessary, elevates and traverses.

No. 3 loads, uncaps or removes safety pin from fuze when in the bore, rams home, attends to brake in running up, runs back when necessary, and places the clutch in or out of gear, and traverses.

No. 4 attends to side arms, supplies them to 2, attends to clamping of elevating gear, traverses, and runs back when necessary.

No. 5 attends to the vent, supplies wedge wads, makes ready, fires, and runs back when necessary.

No. 6 supplies 3 with cartridges.

No. 7 attends to fuzes, brings up projectile and places it on loading derrick.

No. 8 attends to cartridge store and serves out cartridges to 6.

No. 9 attends to shell store, issues shells, tubes, and fuzes.

To Prepare for Action.

Officer.	*No. 1.*
Prepare for action	Prepare for action, Examine Gun.

"Prepare for action."

The stores are brought up as follows:—

No. 1 provides a piece of chalk and fixes sights.

No. 2, iron shod lever, elevating wheel, and assists No. 4 with side arms.

No. 3, iron-shod lever, 4 fathoms of $1\frac{1}{2}$ inch lashing for rammer with jointed stave when necessary, removes the muzzle tampeon.

No. 4, rammer with jointed stave, sponge with wire rope stave, and running-back handle.

No. 5, wedge wads, tubes in box, lanyard, pricker, vent server, and running-back handle.

No. 6, two cartridge cases, which he leaves at the cartridge store, bucket filled and brush (two drill cartridges for drill purposes).

No. 7, fuzes, fuze and shell implements; he obtains the fuze boxes from 9, satisfying himself as to the correctness of fuzes and fuze implements.

No. 8 goes to the cartridge store and prepares to issue cartridges.

No. 9, a brush for cleaning shell, goes to the shell store and prepares to issue shells, tubes, and fuzes, he examines the shells carefully, cleaning them if necessary, and removes burrs from studs, he loosens the fuze hole plugs of shells that will be first issued.

The stores having been brought up or found correct, No. 1 will satisfy himself that the foresights fit properly on the gun, the deflection leaves of the hind sights work easily, and that the clip-plates are secured to the carriage; he ascertains that the hydraulic buffer is filled with the proper amount of oil (5 gallons). He sees that the racers are swept; he receives reports from the Nos. responsible, of any irregularity or deficiency in connection with the different parts of the gun, carriage, platform, stores, ammunition, &c.

2 and 4 place the sponge and rammer in the supports prepared for them, the shell extractor and wad hook in rear, so as not to interfere with the working of any of the guns in the battery, and convenient for those for which intended; 2 sees that the elevating gear is in good working order, 3 examines the bore to see the grooves are free from grit, &c. 5 straps the tube-pocket round his waist on the right side, coils up the lanyard, and passes the bight of it under the tube box strap, fills his box with friction tubes, which he procures from 9, places the pricker in the loop on the side of the carriage, examines the vent server and places it in the vent, the loop of the vent server lanyard over one of the sights. 6 supplies the tank (for reception of the sponge head) with water from the bucket, and places the latter clear of the working of the gun.

"Examine Gun."—No. 5 drifts the vent, replaces the pricker in the loop, and the vent server in the vent; 2 searches the gun after the pricker is withdrawn, supplying himself with the wadhook and replacing it.

The gun having been run back to a convenient position for loading; No. 1 gives the word "unclamp," No. 2 unclamps elevating gear, No. 1 then gives the word "Depress," No. 2 depresses; No. 2 will clamp at "Halt;" the whole of the Nos. take post under cover.

To Load.

Officer.	*No.* 1.
Range——yards. With——load.	With——load.

"Load."

No. 1 gives 7 the nature of shell and length of fuze required, and adjusts the tangent sight.

No. 2 depresses the gun to bring the muzzle in line with the carrier, moves into position for sponging, receives the sponge from 4, sponges as soon as the vent server is in the vent, he then returns the sponge to 4, and receives the rammer with jointed stave; as soon as the cartridge and projectile are in the bore he rams home assisted by 3;* he withdraws the rammer and retains it in his hand, while the wedge wad is being put in; 2 and 3 press it steadily home, jamming it under the head of the projectile with two smart taps, the rammer is withdrawn as before and 2 returns it to 4. Should it appear by the mark on the rammer that the charge is not home, 2 and 3 ram home again before the wedge wad is introduced.

No. 3 draws the cartridge from the cartridge case with his left hand, choke to his left, and places it in the bore; when the projectile on the carrier is swung round opposite the bore by No. 7, he pushes it well in (uncaps the fuze if necessary), and assists 2 to press it home.

No. 4 hands the sponge to 2, and replaces it, he supplies the rammer as soon as the projectile is in the bore, and replaces it, he cleans and damps the sponge.

No. 5 provides 3 with a wedge wad.

No. 6 supplies a cartridge to 3, standing at his right rear and keeping the cartridge case closed till the sponge is out of the bore; 7 brings up the projectile and places it on the carrier; 8 issues a cartridge to 6; 9 issues a shell to 7.

To Run Up.

Officer.	*No.* 1.
	Run up. Halt.

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* Should any difficulty be experienced in ramming home, 2 and 3 may be assisted by a bight of a rope being passed behind each joint of the rammer in succession, and hauled on by any available Nos. of the detachment.

No. 3 sees that the running-back clutch is out of gear, and, carefully releasing the brake lever, allows the gun to run up gently to the front stops.

To Lay, Make Ready, and Fire.

Officer.	*No. 1.*
Commence firing, or Fire —— rounds.	Elevate, halt. Depress " Trail right, halt. Trail left " No. —— ready. No. —— fire.

No. 2 works the elevating wheel, No. 4 the clamping lever, 2 and 3 traverse with iron shod levers.

"Trail, right."—No. 3 stands facing to the rear and applies the point of his lever under the left rear truck of the platform, both hands back up, and heaves the platform over to the right, taking short, quick purchases; 2 takes up his position at the front truck on his own side and works over the front of the platform to the left. At "Halt," 2 withdraws his lever, and with it scotches the rear truck.

"Trail, left."—3 works the front truck, and 2 the rear; 3 scotches the rear truck at "Halt."

At "Ready," 2 and 3 withdraw their levers and place them, bevels up, as scotches under the trucks; 2, 3, and 4 then go under cover; No. 5 hands the tube, with lanyard attached, to No. 1, the other end of the lanyard hanging down the side of the carriage, or, if long, being coiled up and hung on the rear eyebolt. No. 1 puts in the tube when he has laid the gun, giving the word "Ready;" he jumps off the platform and gives the word "No. —" (naming his gun). No. 5 seizes the lanyard and stretches it out, looking towards No. 1. At "Fire" from the No. 1, he draws the lanyard strongly towards him without a jerk; he drifts the vent, replaces the vent-server and pricker, coils up the lanyard and replaces it under his belt, hooks the preventer rope (except at drill), and goes under cover.

To Run Back.

Officer.	*No. 1.*
	Run back, halt. Unload.

At "Run back," No. 3 places the running-back clutch in gear, and Nos. 2, 3, 4, and 5 man the running-back handles, and run back; 3 then puts the clutch out of gear.

To Unload.

The gun should be unloaded when horizontal.

To Cease Firing and Replace Stores.

Officer.	*No. 1.*
Cease firing. Replace stores.	Depress, halt. Replace stores.

The gun is depressed, and the stores are replaced by the Nos. who brought them up.

To Form Detachment Rear.

Officer.	*No. 1.*
Detachment rear.	Outwards turn. Double march. Halt. Front.

"Detachment rear."—No. 1 doubles to the left rear of the platform, turns to the left, and gives the order "Outwards turn;" 2 and 4 turn to their left, 3 and 5 to their right.

"Double march."—4 and 5, followed by 2 and 3, wheel to the right and left, and when clear of the platform to the right, and round No. 1's left shoulder, 6, 7, 8, and 9 coming up into their places; when 2 and 3 have passed him, No. 1 gives "Halt," "Front," and changes his flank by the rear.

Note.—In mounting the carriage on the platform care should be taken that the rear tooth of the carriage rack is just in front of the starting tooth of the buffer.

To Change Rounds.

Officer	*No. 1.*
Change rounds.	Change rounds.

In changing rounds No. 2 becomes 4; 4, 1; 1, 9; 9, 8; 8, 7; 7, 6; 6, 5; 5, 3; 3, 2.

Drill for 64-pr. Gun, mounted on 5-ft. 6-in. Parapet Carriage and Platform.

The drill is the same as for 64-pr. R.M.L. gun, Mark III., mounted to fire over a 6-ft. parapet, with the following exceptions.

General Duties.

No. 2 searches, sponges, rams home, elevates, and runs up. No. 3 loads, uncaps or removes safety-pin from fuze when shell is in the bore, rams home, runs up.

To Prepare for Action.

No. 2,	in addition;	an iron pointed lever.
„ 3	„	an iron pointed lever.
„ 7	„	a running back tackle.
„ 9	„	a running back tackle.

To Run Up.

Nos. 2 and 3 put the iron pointed levers into the sockets and bear down; should it be observed that the gun is running up too rapidly, 2 and 3 raise their levers and check it.

When the gun is in position, No. 1 gives the word "Halt;" 2 and 3 raise their levers till the sockets are touching the stop plates. They then replace them.

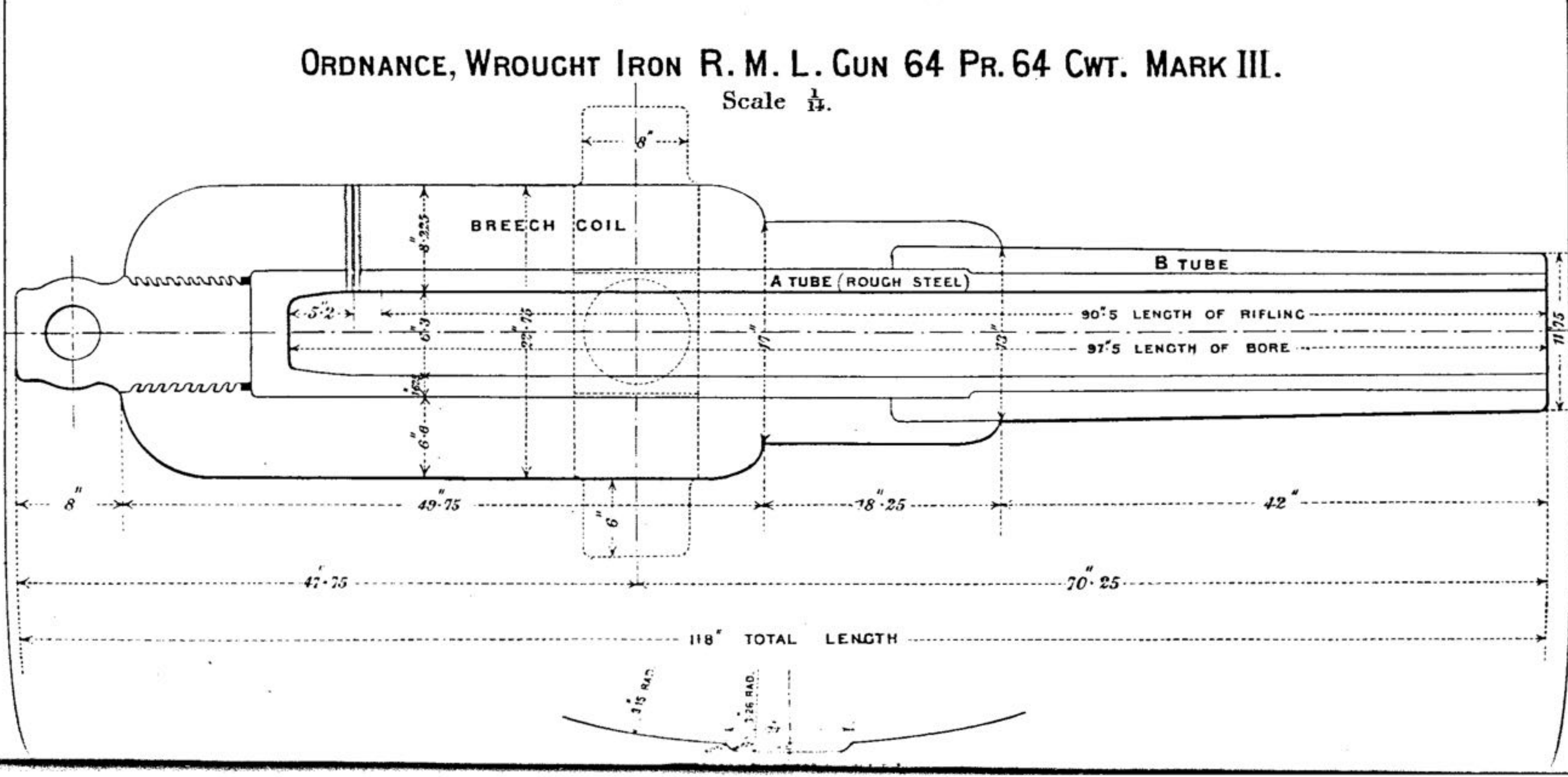
To Run Back.

At "Run back," No. 1 follows up the right front roller with a scotch, 2 and 3 apply their levers and bear down, 4 and 5 fix the pawls, 2 and 3 withdraw their levers and replace them; 4 and 5 overhaul the tackles and hook the double blocks to the front eyebolts of the carriage. The tackles are manned by all the available numbers on their own sides.

At "Halt," 2 and 3 apply their levers and bear down, 4 and 5 release the small pawls. When the gun is back 4 and 5 unhook the front blocks and lay them down after overhauling the tackles.

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Plate I.

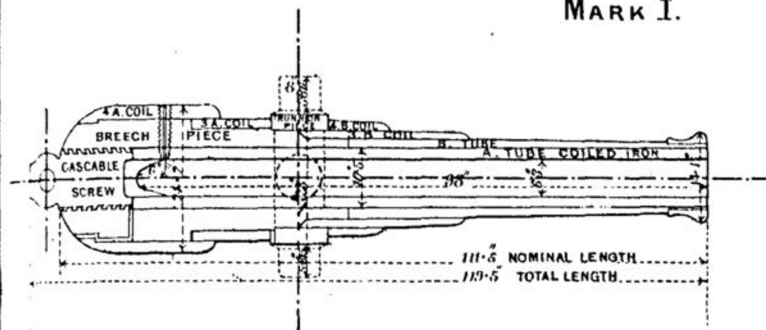


ORDNANCE, WROUGHT IRON R. M. L. GUN 64 PR. 64 CWT. MARK III.
Scale 1/14.
BREECH COIL
A TUBE (ROUGH STEEL)
B TUBE
90"5 LENGTH OF RIFLING
97"5 LENGTH OF BORE
8"
8"·225
5"2
6"3
6"8
22"75
17"
13"
11"75
49"75
18"25
42"
6"
47"75
70"25
118" TOTAL LENGTH
3"15 RAD.
1"26 RAD.

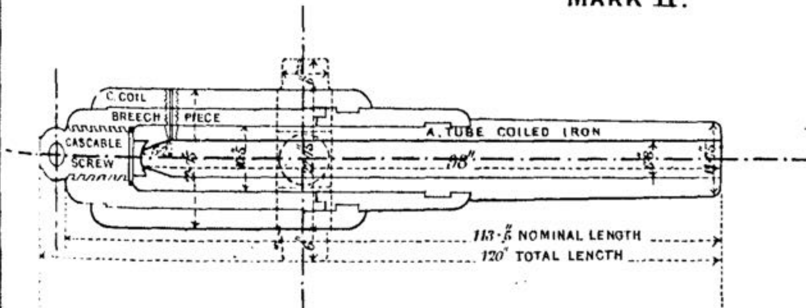
WROT. IRON RIFLED MUZZLE LOADING 64 PR. GUNS OF 64 CWT.

Scale $\frac{3}{8}$ Inch = 1 Foot

MARK I.



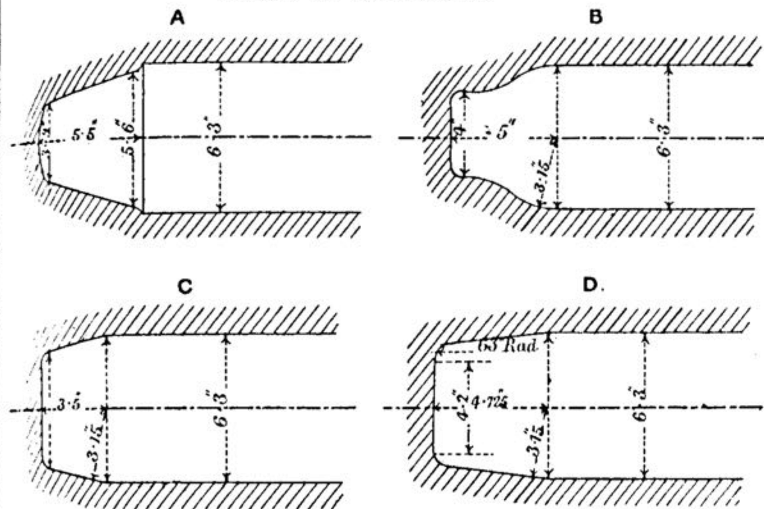
MARK II.



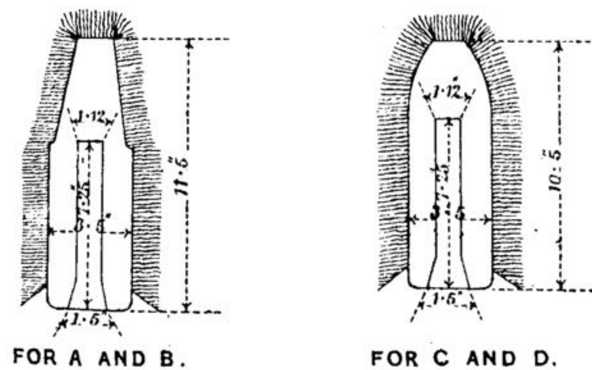
DANGERFIELD, LITH. 22 BEDFORD ST. COVENT GARDEN. 14746. 8/87.

ORDNANCE. R.M.L. 64 PR.

FORMS OF CHAMBERS.



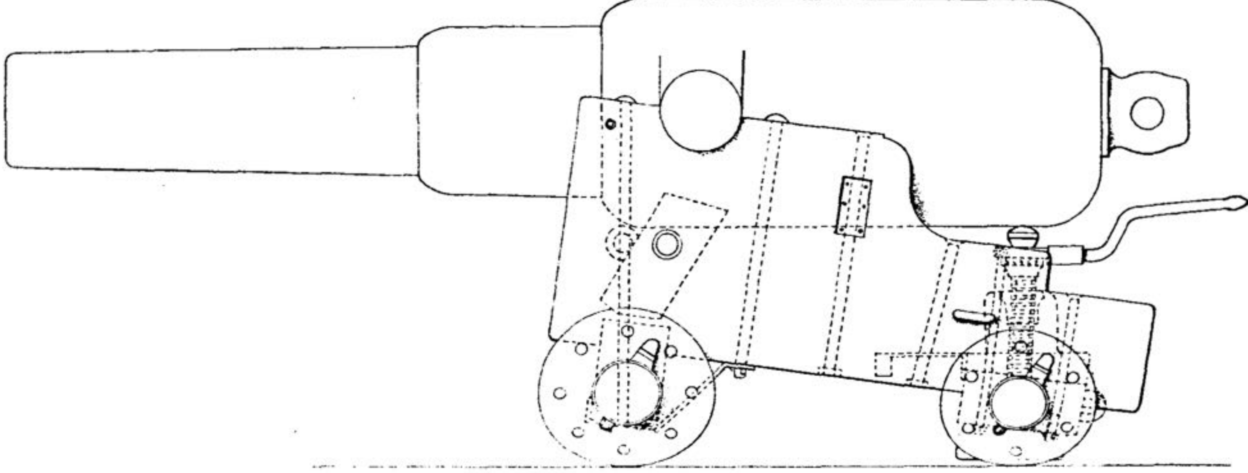
FORMS OF SPONGES.



FOR A AND B. FOR C AND D.

DANGERFIELD, LITH 22, BEDFORD ST COVENT GARDEN.

CARRIAGE, GARRISON, R.M.L. 64 PR., 64 CWT., COMMON, WOOD. WITH WOOD TRUCKS, (CONVERTED NAVAL.)



SIDE ELEVATION.

DANGERFIELD LITH 22 BEDFORD ST COVENT GARDEN

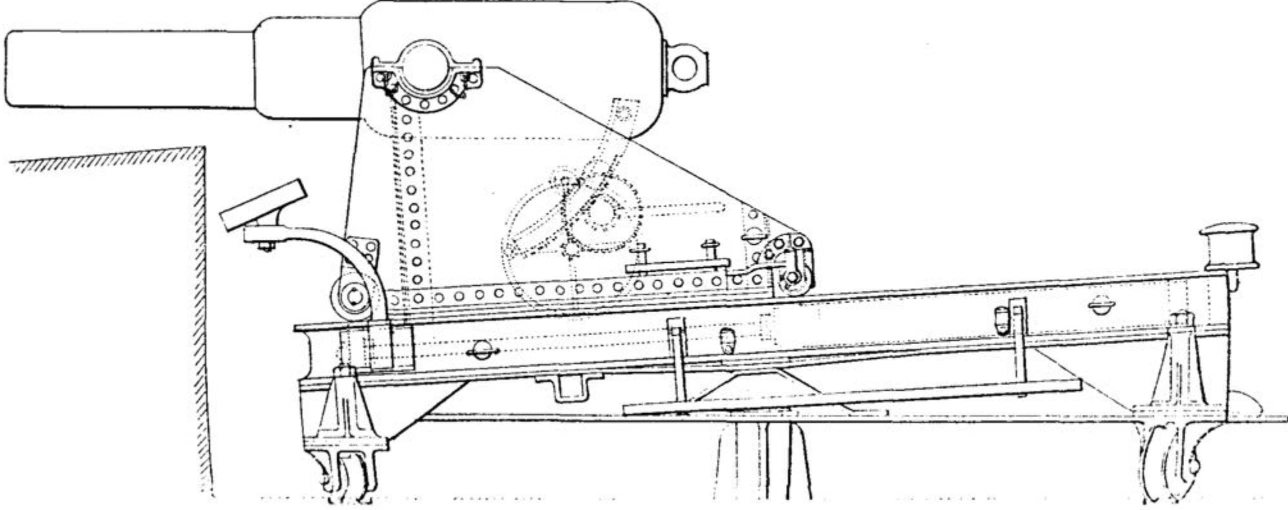
Carriage, Garrison, Sliding, Medium No. 9.

Iron R.M.L. 64 Pr. 64 Cwt. 5 Ft. 6 In. parapet for platform No. 9.

Platform Traversing Medium No. 9.

Iron R.M.L. 64 Pr. 64 Cwt. 5 Ft. 6 In. parapet for carriage No. 9.

Scale $\frac{3}{8}$" = 1 Foot.



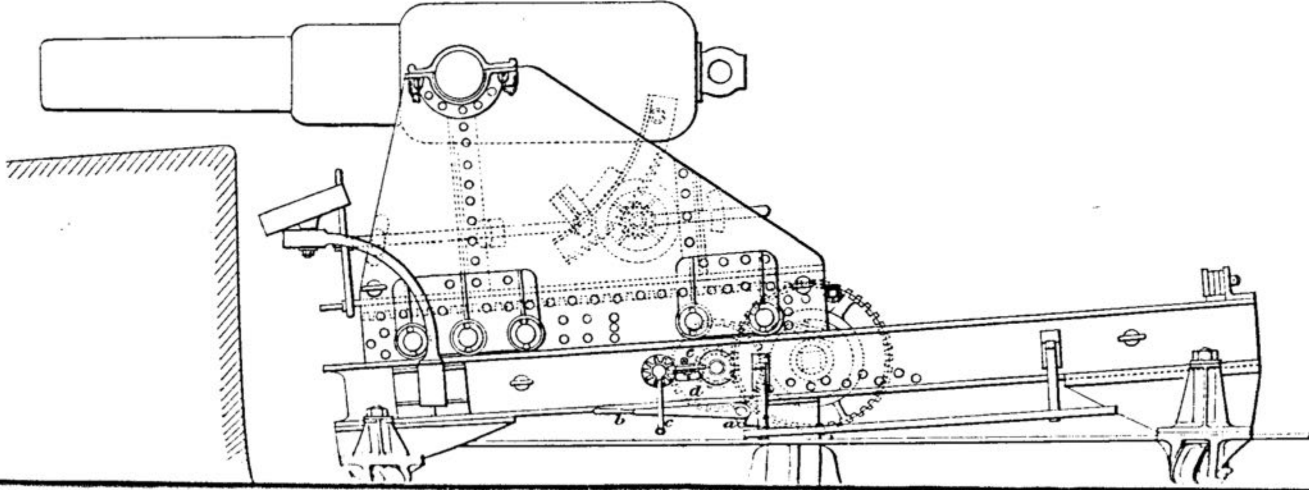
Carriage, Garrison, Sliding, Medium Nº 8.

Iron R.M.L. 64 Pr. 64 Cwt. Mark III gun 6 Ft. parapet for platform Nº 8.

Platform, Traversing Medium Nº 8.

Iron R.M.L. 64 Pr. 64 Cwt. Mark III gun 6 Ft. parapet for platform Nº 8.

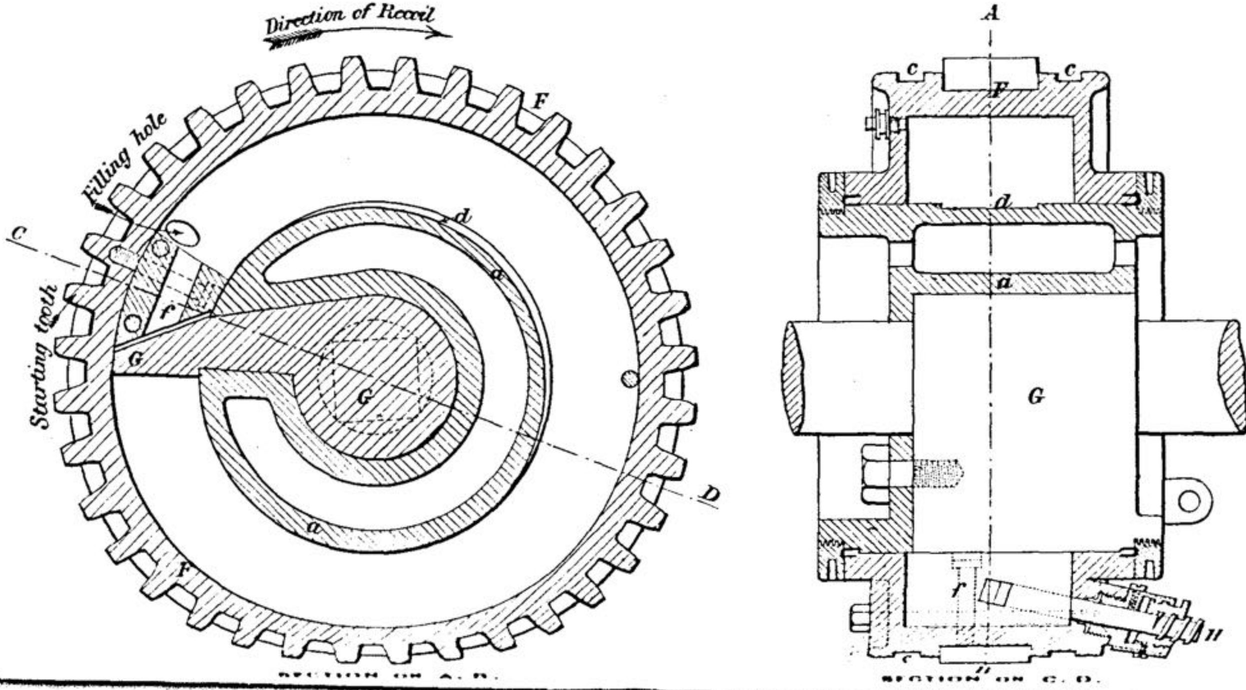
Scale $\frac{3}{8}''$ = 1 Foot.



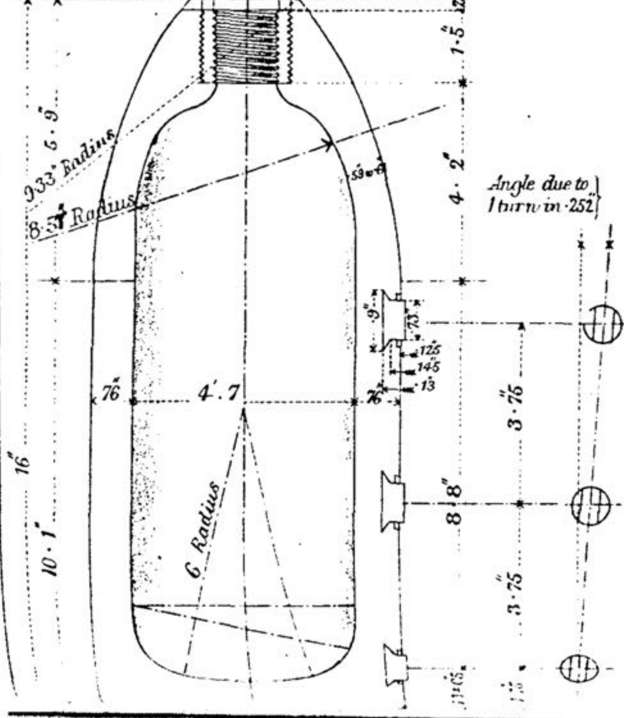
BUFFER, HYDRAULIC CIRCULAR R.M.L. 64 PR.

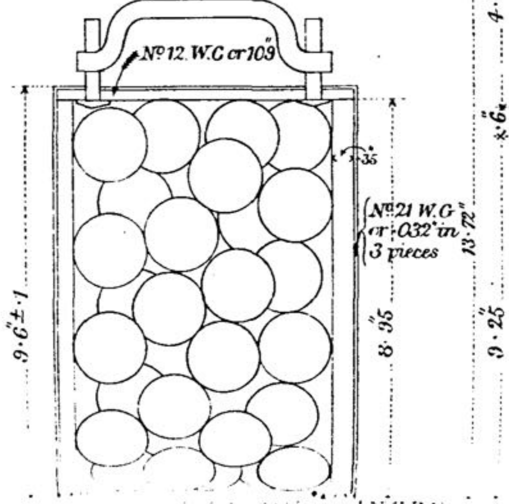
Platform Iron 6 Feet parapet.

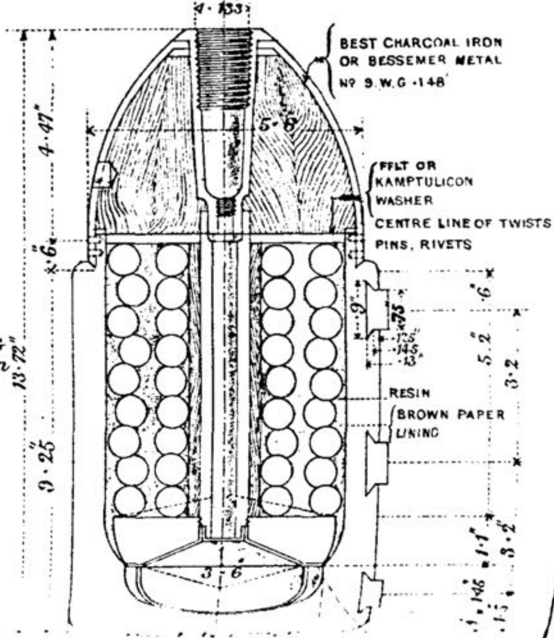
Scale 1½" = 1 Foot.



PROJECTILES.







FUZE TIME WOOD M.L. 15 SECONDS. Nº 41. MARK II.

Full size.

DEVELOPMENT OF PAPER SHOWING

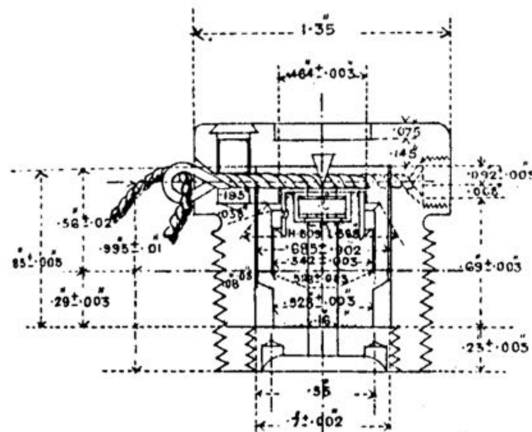
MARKING OF FUZE.

	30	29·5	29	28·5	28
27·5	27	26·5	26	25·5	25
24·5	24	23·5	23	22·5	22
21·5	21	20·5	20	19·5	19
18·5	18	17·5	17	16·5	16
15·5	15	14·5	14	13·5	13
12·5	12	11·5	11	10·5	10
9·5	9	8·5	8	7·5	7
6·5	6	5·5	5	4·5	4
3·5	3	2·5	2	1·5	1

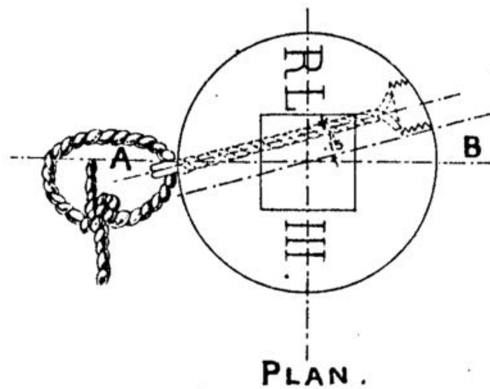
...field Lith 22 Bedford St. Covent Garden 16789.7/88.

FUZE PERCUSSION R.L. No 7 MARK III.

FULL SIZE.



SECTION AT A.B.



PLAN.

DANCERFIELD LITH. 22, BEDFORD ST COVENT GARDEN. 15262. 11/87.